

High Efficiency, High Mass Specific Power Two-Terminal Solar Cells, Phase I

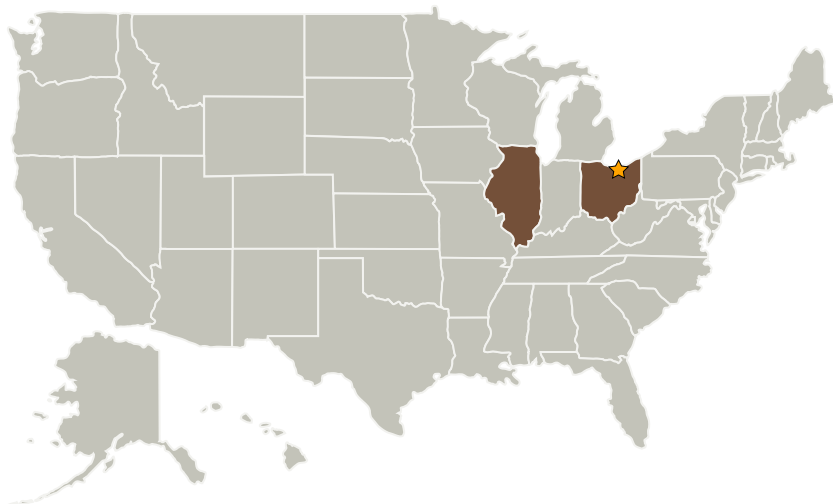
Completed Technology Project (2008 - 2008)



Project Introduction

Future NASA missions will require significant improvements in photovoltaic energy conversion efficiency (>30%) and mass specific power (>600 W/kg), and improved radiation tolerance. We propose to develop a high efficiency monolithic three-junction, two-terminal solar cell using lattice matched HgCdZnTe and/or HgCdMgTe alloys, which will offer great advantages in terms of weight and interconnect simplicity as well as improvements in efficiency. The use of frequency down conversion by divalent Sm/Eu and trivalent Yb/Tb halides embedded in the protective coatings of the solar cells to increase the efficiency of photovoltaic conversion will be investigated. The predicted ideal efficiencies are greater than 50%. During Phase I we will determine the optimal layer thicknesses, doping profiles and current density matching requirements for two-terminal multiple-heterojunction solar cell designs. We will grow HgCdZnTe layers with Zn composition ≈ 0.5 on a Si substrate using a thin CdTe/ZnTe strained-layer superlattice to eliminate cracking and minimize strain, will optimize the growth of HgCdMgTe, and will measure mobilities and minority carrier lifetimes in the layers. We will fabricate and test a two-junction solar cell. Frequency down conversion will be demonstrated, progress toward its optimization will be made, and optical fusion of the solar cell and protective layers will be investigated.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
EPIR Technologies, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Bolingbrook, Illinois

Primary U.S. Work Locations

Illinois	Ohio
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Paul Boieriu

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.1 Power Generation and Energy Conversion
 - └ TX03.1.1 Photovoltaic